

REMARKS

Claims 1-25 are now pending in this application, with claims 1, 4, 5, 12, 19-21, 23, and 25 being in independent form. Claims 1, 4, 5, 8-12, 15, and 19-22 have been amended. Claims 23-25 have been added.

Applicants note with appreciation the indication that claims 19-22 would be allowable if rewritten or amended to overcome the rejections under 35 U.S.C. 112, second paragraph, set forth in the Office Action. Because those rejections are believed to have been overcome, as discussed further below, claims 19-22 are now believed to be in condition for allowance.

Applicants also note with appreciation the indication that claims 8 and 9 would be allowable if rewritten so as not to depend from a rejected claim, and with no change in scope. Applicants have added independent claim 23, which combines features of claims 1 and 8 in view of the Examiner's reasons for allowance presented at pages 15 and 16 of the Office Action. Applicants have also added independent claim 25, which combines the features of claims 1 and 9. Accordingly, independent claims 23 and 25 are believed to be in condition for allowance.

The abstract was objected to for the reasons given at paragraph 2 of the Office Action. It is believed that the abstract has been corrected, and, accordingly, withdrawal of this objection is respectfully requested.

Claims 1-22 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The claims have been carefully reviewed and amended as deemed necessary to ensure that they conform fully to the requirements of Section 112, second paragraph, with special attention to the points raised in paragraph 4 of the Office Action. Applicants also have the following specific comments.

At page 3 of the Office Action, the Examiner states:

Regarding claims 1, 10, 11, 17 and 18, the variable $L_{\text{sub } m}$ is defined as the “weighting coefficients of transmission direction” in lines 6 and 7 of Claim 1. The variable K is defined as the number of transmission channels in line 2 of claim 1. Since the examiner interprets the variable $L_{\text{sub } m}$ and K as defined above, examiner requests for the phrase “... $L_{\text{sub } m}$ channels of directional transmission...” as stated in line 17 of claim 1, to be changed to “... K channels of directional transmission...” in claim 1 and in claims 10, 11, 17 and 18, where appropriate.

However, Applicants disagree with changing L_m to K , for the following reasons.

Claim 1 recites, *inter alia*:

- (a) M diversity groups of transmission channels each having **K transmission channels**, are formed at the base station;
- (b) a pilot signal is transmitted from the base station to the mobile station from each of $M \cdot K$ transmission channels of diversity groups;
- (c) impulse responses of $M \cdot K$ transmission channels of diversity groups are estimated at the mobile station using the transmitted pilot signals;
- (d) L_m sets of weighting coefficients of transmission direction each having $K - 1$ weighting coefficients of transmission direction are formed at the mobile station for each of M diversity groups of transmission channels;
- (e) for each of M diversity groups of transmission channels for each of L_m sets of weighting coefficients of transmission direction a transfer function of a channel of directional transmission corresponding to this set is estimated at the mobile station using the estimated impulse responses of $M \cdot K$ transmission channels;
- (f) a feedback signal containing L_m sets of weighting coefficients of transmission direction for each of M diversity groups of transmission channels as well as an estimated transfer function for each of M diversity groups of transmission channels for each of L_m sets of weighting coefficients of transmission direction is transmitted from the mobile station to the base station; and
- (g) **L_m channels of directional transmission** are formed at the base station for each of M diversity groups of transmission channels **using the transmitted sets of weighting coefficients of transmission direction**.

As a result, we have L_m **channels of directional transmission** formed **using the transmitted sets of weighting coefficients of transmission direction**. L_m is not necessarily equal to K . (L_m may be equal to K , but this is only a particular case).

Also at page 3 of the Office Action, the Examiner states:

In addition, the variable L_m is defined as the “weighting coefficients of transmission direction” in lines 6 and 7 of Claim 1. The variable K is defined as the number of transmission channels (line 2 of Claim 1). Since the examiner interprets the variable L_m and K as defined above, examiner requests for the phrase “...**K** channels of directional transmission...”, as stated in line 17 of claim 1, to be changed to “... K channels of directional transmission...”, where appropriate”. (Emphasis added.)

First, Applicants note that there is probably a typing error in the change suggested above by the examiner; Applicants assume that the K highlighted above in bold and underlining was meant by the Examiner to be L_m . Thus, Applicants assume that, similar to the change described above, the Examiner meant changing L_m to K . Second, Applicants disagree with such a change, for reasons similar to those presented above.

For all the foregoing reasons, it is believed that the rejection under Section 112, second paragraph, has been obviated, and its withdrawal is therefore respectfully requested.

Claims 1-7 and 10-18 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Publication No. US 2005/0117660 (Vialle).

Applicants submit that independent claims 1, 4, 5, and 12, together with the claims dependent therefrom, are patentably distinct from the cited references for at least the following reasons.

Vialle does not negate the novelty of the claimed invention. These are two separate technical solutions, independent from each other.

Vialle (see Fig. 1 attached) uses N transmit antennas (N transmit elements), connected to the base station, which transmit (radiate) the signal to M antennas (M antenna elements) of the mobile station’s receiver. This enables omnidirectional signal transmission from each

diversity antenna. Such signal transmission causes multiple interference in the wireless communication system because it does not provide directional signal transmission (see Fig. 2 attached).

To better understand the differences between Vialle and the claimed invention, consider Fig. 3 (attached).

The difference between the claimed invention and prior art, including Vialle, is that there are M diversity groups of transmission channels each having K transmission channels, usually $K > 1$. By transmission channels Applicants mean antenna elements. That is, each of M diversity groups of transmission channels contains one and more antenna elements. The antenna elements in each group (within a group) are less than a wavelength away from each other while M generated diversity groups of transmission channels are more far away from each other, usually about 10 wavelengths. For each of M diversity groups of transmission channels L_m sets of weighting coefficients of transmission direction each set containing $K-1$ weighting coefficients of transmission direction are formed at a mobile station. For each of M diversity groups of transmission channels for each of L_m sets of weighting coefficients of transmission direction the estimated impulse responses of M transmission channels (antenna elements) of diversity groups are used to estimate the transfer function of the directional transmission channel corresponding to this set. Therefore, K channels are used for directional transmission. The directional transmission reduces the transmission power thereby providing lower internal interference of the wireless communication system due to the phased antenna array effect (see Fig. 4 attached).

In this way the claimed invention allows achieving the technical effect which is impossible to obtain by using Vialle.

In summary, claim 1 is seen to be clearly allowable over Vialle because of the separate technical solutions described above and because the claimed invention provides directional signal transmission unlike Vialle. This means that the claimed invention can allow a better technical effect – reduced transmission power and, thus, lower interference of the wireless communication system. Applicants have not found this distinctive feature in the prior art.

Since Applicants claim a few embodiments of the invention, i.e. method of data transmission, then in addition to the main distinctive feature of enabling directional signal transmission (which is inherent to all embodiments of the method), each embodiment of the invention differs from the previous one in the following distinctive features.

The method of claim 4 estimates transfer functions of directional transmission channels using pilot signals for transmit diversity transmitted in each transmission direction. This increases the quality of estimating transfer functions of directional transmission channels, and thus makes coherent summation of information signal copies on the receiving side more efficient, which ensures higher reception quality at the mobile station.

The method of claim 5 estimates transfer functions of directional transmission channels using pilot signals transmitted from each antenna element and pilot signals for transmit diversity transmitted in each transmission direction. These estimates are later combined. This increases the quality of estimating transfer functions of directional transmission channels, and thus makes coherent summation of information signal copies on the receiving side more efficient, which ensures higher reception quality at the mobile station.

The method of claim 12 entails the formation of weighting coefficients of transmission direction at the base station based on the pilot signal received from the mobile station. Therefore there is no need to transmit the sets of weighting coefficients of

transmission direction from the mobile to the base station, which reduces the feedback channel load.

Generally, the claimed invention allows significantly increased efficiency of data transmission in the downlink of the wireless communication system and, thus, can maximize the signal reception quality at the mobile station. Moreover, the claimed solution also reduces the feedback channel load.

For at least the foregoing reasons, independent claims 1, 4, 5, and 12 are seen to be clearly allowable over Vialle.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Respectfully submitted,

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